lesson 4: chain of foods

estimated time
1½–2 hours

science GLEs
EC.2.A.3.a. Identify sunlight as the primary source of energy plants use to produce their own food
EC.2.A.3.b. Classify populations of organisms as producers or consumers by the role they serve in the ecosystem
EC.2.A.3.c. Sequence the flow of energy through a food chain beginning with the sun
EC.2.A.3.d. Predict the possible effects of removing an organism from a food chain
ME.2.C.3.a. Recognize the sun is the primary source of light and food energy on earth
LO.1.E.5.b. Distinguish between plants (which use sunlight to make their own food) and animals (which must consume energy-rich food)

vocabulary
Food chains
Producers
Consumers
Nocturnal

lesson objectives
1. Identify the primary source of energy plants use to produce their own food.
2. Explain the difference between a producer and a consumer.
3. Classify populations of organisms as producers or consumers by the role they serve in the ecosystem.
4. Sequence the flow of energy through a food chain beginning with the sun.
5. Predict the possible effects of removing a population of organisms from a food chain.

essential questions for the lesson
1. Where do organisms get their energy?
2. Where do you get your energy?
3. What is the relationship between the sun and living organisms?
4. Why is it important to have strong food chains in (healthy) ecosystems?

teacher notes
Students should have read Chapter 4, "Chain of Foods," on pages 18–23 of their student books prior to engaging in these activities.

outline of answers to objectives
See following page.

essential activities
Activity 4.1: Basic Food Chain Paper Links
Activity 4.2: Food Chains
Activity 4.3: Schoolyard Ecosystem Food Chains

optional activities
Optional Activity 4.A: MDC video segments
Optional Activity 4.B: Owl Pellet Dissection Practice
Optional Activity 4.C: Owl Pellets—The Real Deal
Optional Activity 4.D: Beaks, Seeds and PlacesTo Eat

summary
Plants and animals need and use the energy of the sun in different ways. Plants are producers because they use sunlight directly for energy to make their own food. Animals are consumers because they get their food and energy by eating plants and other animals. Energy from the sun is passed up through all food chains—as the producers (plants) are eaten by the consumers (animals). When a population in a food chain is eliminated, the rest of the food chain is affected.

outline of answers to objectives—lesson 4

1. Identify the primary source of energy plants use to produce their own food. (page 18)
   a. The sun

2. Explain the difference between a producer and a consumer. (page 19)
   a. Producers are organisms that make their own food. Plants are producers. Each plant acts as its own food factory using energy from the sun to create or "cook up" its "energy recipe." Carbon dioxide from the air and minerals from the soil and water are used by plants in this "recipe", but sunlight is the key ingredient.
   b. Consumers are organisms that eat other organisms to get the energy they need to survive. Animals eat other organisms so they are consumers. A portion of the energy from the sun is passed from the plant to an animal and from that animal to another animal.

3. Classify populations of organisms as producers or consumers by the role they serve in the ecosystem. (pages 19–23)
   a. Pond ecosystem
      i. Producers—examples include cattails, arrowhead plants, algae
      ii. Consumers—examples include tadpoles, great blue herons, water fleas, predacious diving beetles, largemouth bass, fishing spiders
   b. Forest ecosystem
      i. Producers—example includes hickory trees
      ii. Consumers—squirrels, owls, pileated woodpeckers, Io moth caterpillars, sowbugs, ovenbirds, bobcats, flying squirrels
   c. Prairie ecosystem
      i. Producers—grasses
      ii. Consumers—rabbits, coyotes, mice, voles, snakes, hawks, grasshopper sparrows, leaf beetles, grassland crayfish, northern crawfish frogs, speckled kingsnake

   * NOTE: Additional producers and consumers are included on the posters—Missouri Pond Life; Forests: Layers of Leaves; Prairie: Life Among the Grasses. The back of each poster provides this information.

4. Sequence the flow of energy through a food chain beginning with the sun. (pages 19–23)
   a. Pond ecosystem examples
      i. Sun ➲algae ➲tadpole ➲fish ➲great blue heron
      ii. Sun ➲algae ➲water flea ➲predacious diving beetle
   b. Forest ecosystem examples
      i. Sun ➲hickory tree (nut) ➲squirrel ➲great horned owl
      ii. Sun ➲leaves ➲sowbug ➲ovenbird
   c. Prairie ecosystem examples
      i. Sun ➲grass (seed) ➲rabbit ➲coyote
      ii. Sun ➲decaying plants ➲leaf beetle ➲grassland crayfish ➲northern crawfish frog

5. Predict the possible effects of removing a population of organisms from a food chain.
   a. When populations of organisms disappear from communities, food chains break down and the entire ecosystem is weakened.
   b. Pond example—If all frogs in the pond become sick and die, fish and other frog-eating animals in and around the pond would have less food to eat.
   c. Prairie example—If prairie grasses disappeared, populations of mice and voles would decrease because they would have less of their main food source to eat. Populations of snakes that get energy from the mice and voles they eat would decrease. Hawks would have fewer mice, voles, and snakes to eat and feed their young.

activity 4.1 : basic food chain paper links

estimated time 30 minutes

objectives

Students will be able to

1. Identify the primary source of energy plants use to produce their own food.
2. Explain the difference between a producer and consumer.
3. Sequence the flow of energy through a food chain beginning with the sun.

teacher preparation

Student should have read Chapter 4, "Chain of Foods," on pages 18–23 of their student books prior to engaging in these activities.

This activity will serve as a review for students who have studied food chains in a lower grade as well as a basic introduction to the concept of food chains.

Paper strips (*Activity 4.1 Food Chain Components*) should be photocopied, cut out and available for students along with Scotch tape. If possible, pages should be photocopied on colored paper.

For example:

—yellow paper for strips SUN pictures.
—green paper for strips with the word PRODUCER and various producer pictures.
—blue paper for strips with the word PLANT CONSUMER and various pictures of animals that eat plants.
—brown paper for strips with the word ANIMAL CONSUMER and various pictures of animals that eat other animals.

materials

Colored strips (as noted above)
Scotch tape
Student books
Flip chart/white board and markers

procedure

1. Review the concept and basic components of a food chain.
   Q. When we talk about a food chain, what do we mean?
   A. Answers may vary. Food chains pass energy from the sun up through producers and through consumers that eat producers. Plants make their own food by using energy from the sun, and animals get their energy by eating plants and other animals.
   Q. How are people part of food chains?
   A. People get energy by eating plants and animals.

2. Have students work in groups of three to four. Instruct them to think about the most recent meal they have eaten and how one or more parts of their meal can be traced back to the sun.
   Q. What did you have for breakfast/lunch/snack/dinner?
   A. Answers will vary. Choose one item from one student's meal and work the food chain links from the sun to the student. For example, if a student ate a hamburger with ketchup and pickles on a bun and drank a container of milk, write the food chain links on the board and talk through each link as shown in brackets:

   Sun➲Grass➲Cow➲Student

   [The sun provided energy to the grass to produce its own food. Energy from the grass was passed along to the cow when the cow ate/consumed it. Energy from the cow was passed along to the student when the student ate/consumed the cow (in the form of a hamburger).]

   Sun➲Tomato➲Student

   [The sun provided energy to the tomato (plant) to produce its own food. Energy from the tomato was passed along to the student when the student ate/consumed it (in the form of ketchup).]

   Sun➲Pickle➲Student

[The sun provided energy to the pickle (plant) to produce its own food. Energy from the pickle was passed along to the student when the student ate/consumed it.)]

Sun➲Wheat➲Student

[The sun provided energy to the wheat (plant) to produce its own food. Energy from the wheat was passed along to the student when the student ate/consumed it (in the form of flour baked into a bun).]

Sun➲Grass➲Cow➲Student

[The sun provided energy to the grass to produce its own food. Energy from the grass was passed along to the cow when the cow ate/consumed it. Energy from the cow was passed along to the student when the student drank/consumed the milk.]

3. Have students look at the food chains on the board:
   Q. Which items in these meals are producers? What makes them producers?
   A. The grass, tomato (in the form of ketchup), pickle and wheat (in the form of a bun) are producers because they are plants that get their energy to make their own food directly from the sun.
   Q. What are the cow and the student?
   A. The cow and the student are consumers.
   Q. Why are they called consumers?
   A. Consumers eat or consume other organisms to get energy. The cow consumed the grass to get energy, and the student consumed the tomato, the pickle, the wheat (in the form of a bun) and the cow (in the form of a hamburger).

4. Have students work in groups to create one set of food chain links for a composite of their most recent meal. Instruct them to be prepared to present their food chains to the class in such a way that each group member explains one or more links, depending on the length of the chain(s). Instruct students to follow the pattern demonstrated above and list each set of links and explain each chain, link by link, backwards from the student to the sun. Students should put a "P" above the producers and a "C" above the consumers in their chains.

   For example, students will discuss what each of them recently ate and decide on one group of meal items to use. (Ex: One student ate a peanut butter and jelly sandwich and Oreo cookies. Another student ate a hamburger with French fries. A third student ate a hot dog with mustard and relish and had Jell-o* for dessert. Students could choose to do a set of food chain links for a "composite" student who ate a peanut butter and jelly sandwich, French fries and Jell-o for lunch.)

   ** Items such as Jell-o might give students difficulty. Ask them what they think the main ingredient in Jell-o is besides water—sugar. Sugar comes from sugar cane which is a plant that produces its own food by using energy from the sun. Work students through similar thought processes with other food items with main ingredients not easily identified.*

5. Have students look at the food chains in their student books on the bottom of pages 19, 21 and 23 for the pond, forest and prairie ecosystems. Beginning with the sun, have students recite each link in each food chain with you. For example, the food chain on the bottom of page 19 for the pond ecosystem shows: Sun➲algae➲water flea➲predacious dividing beetle. The sun gave energy to the algae (a producer) which it used to make its own food. When the algae was eaten by the water flea (a consumer), energy was passed to the water flea. When the water flea was eaten by the predacious diving beetle (a consumer), energy was passed to the predacious diving beetle.
   Q. How could this chain be made shorter or longer?
   A. It could have been a shorter food chain if the water flea had eaten the algae and died because the pond water dried up. It could have been longer if a green frog (a consumer) had come along and eaten the predacious diving beetle *and then* a northern water snake (a consumer) had come along and eaten the green frog.
   Q. How else could this food chain have been different?
   A. Answers will vary. The water flea could have been eaten by a blue-fronted dancer dragonfly nymph (a consumer) that could have been eaten by a bluegill fish (a consumer).
   Q. How would you describe the forest food chain on the bottom of page 21 of your books?
   A. Sun➲decaying leaves➲sowbug➲ovenbird:
      - The sun gave energy to the leaves (producers) when they were still living which the leaves used to make their own food. When the decaying leaves were eaten by the sowbug (a consumer), energy that was still contained in the decaying leaves was passed to the sowbug. When the sowbug was eaten by the ovenbird (a consumer), energy was passed to the ovenbird.
      - This could have been shortened if the sowbug (after eating the decaying leaves) had died from being stepped on by a deer walking through the woods.

- This could have been longer if a black rat snake (a consumer) had slithered along and eaten the ovenbird *and* a great horned owl (a consumer) swept down and grabbed and ate the black rat snake.

Q. How would you describe the prairie food chain on the bottom of page 23 in your books?

A. Sun➲decaying plants➲leaf beetle➲grassland crayfish➲northern crawfish frog

- The sun gave energy to the decaying plants (producers) when they were still living which the plants used to make their own food. When the decaying plants were eaten by the leaf beetle (a consumer), energy that was still contained in the decaying plants was passed to the leaf beetle. When the leaf beetle was eaten by the grassland crayfish (a consumer), energy was passed to the grassland crayfish. When the grassland crayfish was eaten by the northern crawfish frog (a consumer), energy from the grassland crayfish was passed along to the northern crawfish frog.
- This food chain could have been shorter if a badger (a consumer) had come along and eaten the northern crawfish frog before it had a chance to eat the grassland crayfish.

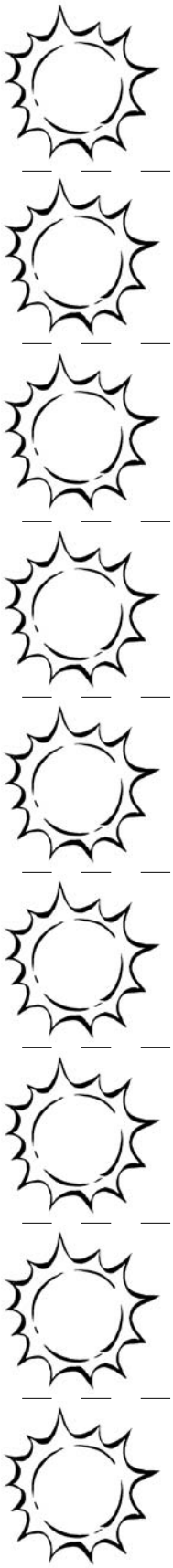
6. Using the paper chain cut-outs and Scotch tape, have students make their own simple food chains. Students should choose a sun strip, a producer strip, a plant consumer strip and an animal consumer strip. The link a student decides to use as the first link should be looped over and taped one end over the other (like a bracelet). The second link chosen by the student should be slipped through the first link, looped over and taped one end over the other (the beginning of a chain). Students should continue adding links to their food chains.

7. Have students share their links checking to see that the simple connections are possible ones and that every chain begins with the sun and moves to a producer and then consumers. Have students use the same repeated phrases as used for the first food chain they created that included humans.

8. Discuss what might happen to their chains if one paper link were torn apart and removed. Discuss what might happen if the organisms in their food chains were removed from an ecosystem.

Wrap-up/formative assessment See *Wrap-Up/Formative Assessments* in the Teacher Notes section of the introductory material to choose a strategy that meets student needs.

Adapted with permission from Linda Chorice, Missouri Department of Conservation Springfield Conservation Nature Center



Producer 

Producer 

Producer 

Producer 

Producer 

Producer 

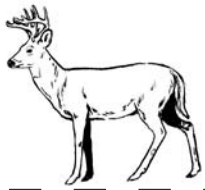
Producer 

Producer 

Producer 

Plant
Consumer

Plant
Consumer



Plant
Consumer

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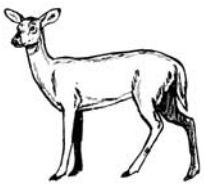
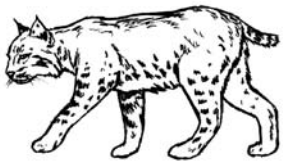
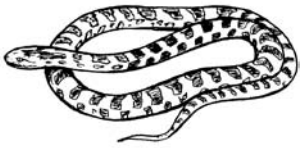


Animal Consumer 

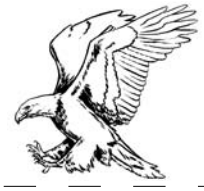
Animal Consumer 

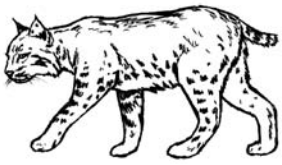
Animal Consumer 

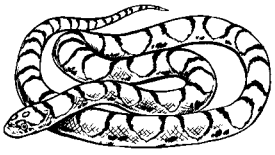
Animal Consumer 

Animal Consumer 

Animal Consumer 

Animal Consumer 

Animal Consumer 

Animal Consumer 

activity 4.2 : food chains

estimated time 30 minutes

objectives

Students will be able to

1. Identify the primary source of energy plants use to produce their own food.
2. Explain the difference between a producer and consumer.
3. Sequence the flow of energy through a food chain beginning with the sun.
4. Classify populations of organisms as producers or consumers by the role they serve in the ecosystem.
5. Predict the possible effects of removing a population from a food chain.

teacher preparation

This activity will work best in a large, open area such as the schoolyard or ball field.

It is recommended to:

- make two or three copies of the *Food Chain Cards*.
- laminate the *Food Chain Cards*.
- punch two holes on either side of the top of each card.
- lace yarn through the holes and tie the ends together. Yarn should be long enough to go easily over the heads of students and hang loosely enough around their necks to allow them easy access to the information on the cards.
- separate the Producer Cards from the Consumer Cards.

Extra sets of cards will allow for classes with more than 20 students, will allow teachers to increase the number of food chains based on the number of Producer Cards included in each session, and will allow students to create different food chains in each session. Place any extra cards aside.

Brackets indicate "top" consumers that are not included in these cards. For the purposes of this game, consumers with bracketed information should be the last consumers in any of these food chains.

Basic sets of cards should include:

Number of students	Sun card	Producer cards	Consumer cards
20	1	8–10	15
25	1	8–15	15–20
30	1	12–20	20–25

materials

Science notebooks
Pencils
Thermometers
Student Food Chain Cards (laminated and prepared as suggested above)
Food Chain Key
8–10 balls of yarn

procedure

1. Have students complete their science notebook headings and take and record outside air temperature.

2. Sort *Food Chain Cards* (Producers/Consumers) and count out the number of each required for one session. Be sure to include the Sun card when the cards are randomly handed out. Place the balls of yarn in the center of the open area.

3. Shuffle Producer Cards and shuffle Consumer Cards. Distribute cards randomly and instruct students to read their cards carefully. Remind them that they will need to know 1) what plant or animal they are, 2) whether they are a producer or a consumer, and 3) how they get their energy (ex: make their own using the sun; consume a plant; consume an animal).

4. Instruct students to place the cards loosely around their necks in order to free their hands and to keep the information close to them.

5. After reading the information on their cards, ask students with Producer Cards to stand to your right.

6. Ask students with Consumer Cards to stand to your left.
   Q. Who is left alone?
   A. The student with the Sun card should be left standing alone, because the sun is neither a producer nor a consumer.

7. Provide a ball of yarn to the student with the Sun card. Address the student with the Sun card *(in a dramatic, fun voice)* and provide him/her with instructions similar to: "You are the sun, and all our chains will begin with you. None of our producers or consumers can survive without you, so you must be very careful not to drop your end of the yarn because it connects you with each food chain. Are you up to the task of representing the sun?"

8. Connect producers to the sun:
   - Choose one student with a producer card (from those to your right) and have that producer introduce him/herself to the group and explain why he/she is a producer. (Ex: I am algae and I am a producer because I make my own food using energy from the sun.)
   - Hand the loose end of a ball of yarn to the sun and hand the ball of yarn to the producer unwinding enough yarn to allow about two feet of space between them.
   - Refer back to the group of producers and choose another producer and repeat the above process using a new ball of yarn for each producer. Continue until all producers are connected to the sun with a piece of yarn. Producers should not be connected in any way to each other.

   Q. If these producers get their energy directly from the sun, what would get its energy directly from a producer?
   A. A consumer would get its energy directly from a producer.

9. Connect consumers to producers:
   - Ask students with consumer cards (those to your left) to raise their hand if they think they could be connected to one of the producers connected to the sun. As you choose students with raised hands, have each consumer introduce him/herself to the group and explain why he/she is a consumer. (Ex: I am a grasshopper and I am a consumer because I get my energy by eating or consuming grasses and leaves; or I am a coyote and I eat or consume rabbits, voles, grasshoppers, robins, young deer and insects but I also consume fruits and berries; or I am a deer and I eat or consume acorns, leaves, fruits and berries, wildflowers and grasses.) Have students double check what they eat to be sure a proper link in each food chain is formed. Students representing consumers that eat both plants and animals may step up as long as there are student producers available that match up with what is listed on their cards.
   - Have each consumer stand next to a producer they consume. Have the producer continue to hold onto the strand of yarn while he/she unwinds and passes the ball of yarn to the consumer. Enough yarn should be unwound to allow about two feet of space between them. Continue until all producers are connected to the sun on one side and a consumer on the other. Producers should continue to hold onto the piece of yarn.
   - Any consumers who eat or consume only producers left unlinked to a food chain should stand over to one side.

10. Connect consumers to consumers:
    - Ask remaining students with consumer cards to join a food chain where they think they belong (next to a consumer that their cards tells them they consume). Have each new consumer introduce him/herself to the group and explain why he/she is a consumer and why he/she believes he/she should be linked to that particular food chain. (Ex: I am a spider and I am a consumer because I get my energy by eating or consuming insects; or I am a coyote and I eat or consume rabbits; or I am a black rat snake and I eat or consume woodland voles.)
    - Have students unwind the ball of yarn as it is passed to the new consumer. Enough yarn should be unwound to allow about two feet of space between them.The sun and all producers and consumers should continue to hold onto the piece of yarn.
    - Any consumers who eat or consume only consumers left unlinked to a food chain should join the other unconnected consumers over to the side.

11. Look at all these food chains you've created. Congratulations! You are organisms getting the energy you need either directly from the sun or by consuming producers or other consumers. Wait a minute! (Refer to the unlinked consumers.)
    Q. What happened to these consumers?
    A. They were not able to find the right food to eat.
    Q. But we have all this food in all these chains. Why couldn't they find what they needed?
    A. Other consumers ate their food; the animals that eat both producers and consumers had more choices; etc.
    Q. What might happen to these consumers?
    A. They might be hungry for a while until they find more food; they might starve and die; they might move away from their community to find food somewhere else; etc.
    Q. I wonder if there are any places we might include them in our food chains.
    A. Elicit suggestions from students and ultimately lead them to have each unlinked consumer read what they eat and try to find a place along a food chain for them to fit. Have the last consumer holding the ball of yarn unwind enough yarn to allow for any additional "links" to be inserted.

    Some possible examples:
    A chain that has: sun ➲ algae ➲ tadpole ➲ water snake
    could become: sun ➲ algae ➲ tadpole ➲ water snake ➲ **black rat snake**
    A chain that has: sun ➲ leaves ➲ insects ➲ robin ➲ black rat snake
    could become: sun ➲ leaves ➲ insects ➲ **dragonfly** ➲ robin ➲ black rat snake

12. Have students include as many as possible. Referring to any remaining consumers:
    Q. What shall we do with these unlinked consumers? What would happen in nature to a consumer that was not able to find food?
    A. Consumers unable to find food would eventually starve and die.
    Q. What happens to the bodies of consumers that die?
    A. Their bodies break down and eventually become part of the soil.
    Q. If these consumers become part of the soil, where could they possibly be placed within our food chains?
    A. The dead consumers could become part of the soil used by the producers.

13. Have any unlinked students stand around the producers (but not become part of a chain) because now they have become part of the soil that will provide nutrients to the producers.

14. Have each chain discuss its parts (ex: I'm a coyote which is a consumer that got its energy by eating a rabbit; I'm a rabbit which is a consumer that got its energy by eating grasses; I'm grass which is a producer that is able to make its own food by using energy from the sun. *(In a big booming voice)* I am the sun, and all food chains begin with me!) This repetition (and the repetition above as students initially link up) will reinforce the concept and will help capture students who may not have grasped the concept and/or did not understand how to use the cards.

15. Discuss whether or not any of these food chains would be found in a pond, a forest or a prairie ecosystem. Answers will vary. Quite often, animals move from one ecosystem to another. A black rat snake may be found in a forest ecosystem, but it also seeks water at ponds; a deer may be associated with a forest ecosystem, but it might also forage on grasses and wildflowers in a prairie; etc.

16. Addressing all the food chains:
    Q. What role do all the producers here play in their ecosystems?
    A. Producers use energy from the sun to produce their own food which makes the plants/producers grow.
    Q. What role do all the consumers here play in their ecosystems?
    A. Consumers eat producers and other consumers in order to get energy.
    Q. What would a possible effect be on a food chain if an entire link were missing?
    A. A consumer or several consumers would not have that producer or consumer to eat.

17. To see how that might look, ask the grasses to release their piece of yarn.
    Q. What just happened and what might happen?
    A. A producer is gone, and the consumer that was connected to that producer will have to find something else to eat, and the consumers after the first consumer might have to find something else to eat.

Q. Raise your hand if you just "lost a meal." Would you starve?

A. Not unless all producers they eat in their ecosystem were gone, and they couldn't find the food they needed. If possible, they might go somewhere else for food.

Q. What might happen to a consumer that eats only one type of food and that food disappears?

A. Answers will vary. That consumer could starve or attempt to eat something else or move away, if possible, to where it could find more of its food.

18. Have the grasses rejoin their food chain by grasping the strand of yarn.

Q. Looking at all these food chains, is there one consumer we don't really need?

A. Answers will vary. Essentially, all consumers, even those that students may not like (snakes, voles, etc.) are all important parts of food chains and play a part in keeping a balance among populations. (Ex: Remove mice/voles = less food/energy for snakes.)

19. Think about what you've read about pond, forest and prairie ecosystems.

Q. Which ecosystem (pond, forest or prairie) might be the most difficult one for consumers to find other sources of food?

A. Certain pond ecosystem consumers, such as fish, certain aquatic insects, etc. would not be able to move away from one pond to another to find food.

Wrap-up/formative assessment

In their science notebooks, instruct students to create written or illustrated food chains that include either their breakfast, lunch or last night's dinner.

Sun

Acorns

Eaten by deer

Algae

Eaten by tadpoles, pond snails

Aquatic plants

Eaten by pond snails

Fruits & berries

Eaten by deer, woodland voles, box turtles, coyotes, rabbits, robins

Grasses

Eaten by grasshoppers, deer, insects, rabbits

Leaves

Eaten by grasshoppers, deer, insects, woodland voles, box turtles, rabbits

Seeds

Eaten by woodland voles, robins

Wildflowers

Eaten by insects, rabbits, deer

Deer

Eats acorns, grasses, fruits & berries, wildflowers, leaves

Eaten by coyotes

Grasshopper

Eats grasses, leaves

Eaten by robins, spiders, coyotes

Insects

Eats leaves, grasses, wildflowers

Eaten by robins, dragonflies, box turtles, green frogs, spiders

Pond snail

Eats algae, aquatic plants

Eaten by green frogs

Rabbit

Eats grasses, wildflowers, leaves, fruits & berries

Eaten by black rat snakes, coyotes

Tadpole

Eats algae

Eaten by water snakes

Woodland vole

Eats leaves, seeds, fruits & berries

Eaten by coyotes, black rat snakes

Black rat snake

Eats rabbits, woodland voles, robins, rabbits

[**Eaten by** other snakes, owls, hawks]

Box turtle

Eats leaves, fruits & berries, insects

[**Eaten by** skunks, raccoons, badgers]

Coyote

Eats rabbits, woodland voles, robins, grasshoppers, fruits & berries, young deer

[Young coyotes
Eaten by owls]

Dragonfly

Eats insects, dragonflies

Eaten by robins, green frogs, dragonflies

Green frog

Eats insects, spiders, pond snails, dragonflies

Eaten by water snakes

Robin

Eats seeds, fruits & berries, spiders, dragonflies, insects, grasshoppers

Eaten by black rat snakes, coyotes

Spider

Eats insects, grasshoppers

Eaten by robins, green frogs

Water snake

Eats green frogs, tadpoles

[**Eaten by** great blue herons, raccoons]

Organism	Producer or Consumer	Eats (Gets energy)	Eaten by	Possible ecosystem
PRODUCERS				
Acorns	Producer	Energy from Sun	Deer	Forest, near ponds
Algae	Producer	Energy from Sun	Tadpoles Pond snails	Pond
Aquatic plants	Producer	Energy from Sun	Pond snails	Pond
Fruits & berries	Producers	Energy from Sun	Deer Woodland voles Box turtles Coyotes Rabbits Robins	Forest, prairie, near ponds
Grasses	Producer	Energy from Sun	Grasshoppers Deer Insects Rabbits	Forest, prairie, near ponds
Leaves	Producer	Energy from Sun	Grasshoppers Deer Insects Woodland voles Box turtles Rabbits	Forest, near ponds/prairies
Seeds	Producer	Energy from Sun	Woodland voles Robins	Forest, prairie, near ponds
Wildflowers	Producer	Energy from Sun	Insects Rabbits Deer	Forest, prairie, near ponds

Organism	Producer or Consumer	Eats (Gets energy)	Eaten by	Possible ecosystem
CONSUMERS—HERBIVORES				
Deer	Consumer	Grasses Fruits & berries Wildflowers Leaves Acorns	Coyotes	Forest, near prairies/ponds
Grasshopper	Consumer	Grasses, leaves	Robins Spiders Coyotes	Forest, prairie, near ponds
Insects	Consumer	Leaves Grasses Wildflowers	Robins Dragonflies Box turtles Green frogs Spiders	Forest, prairie, around ponds
Pond snail	Consumer	Algae Aquatic plants	Green frogs	Pond
Rabbit	Consumer	Grasses Wildflowers Leaves Fruits & berries	Black rat snakes Coyotes	Forest, near prairies and ponds
Tadpole	Consumer	Algae	Water snakes	Pond
Woodland vole	Consumer	Leaves Seeds Fruits & berries	Black rat snakes Coyotes	Forest

Organism	Producer or Consumer	Eats (Gets energy)	Eaten by	Possible ecosystem
CONSUMERS—CARNIVORES/OMNIVORES				
Black rat snake	Consumer	Rabbits Woodland voles Robins	[Other snakes, owls, hawks]	Forest, near ponds/prairies
Box turtle	Consumer	Leaves Fruits & berries Insects	[Skunks, raccoons, badgers]	Forest, prairie, near ponds
Coyote	Consumer	Rabbits Woodland voles Fruits & berries Robins Grasshoppers Young deer	[Young coyotes eaten by owls]	Forest, near ponds/prairies
Dragonfly	Consumer	Insects Dragonflies	Robins Green frogs Dragonflies	Pond, near forests/prairies
Green frog	Consumer	Insects Spiders Pond snails Dragonflies	Water snakes	Pond
Robin	Consumer	Seeds Fruits & berries Insects Grasshoppers Spiders Dragonflies	Black rat snakes Coyotes	Forest, near ponds/prairies
Spider	Consumer	Insects Grasshoppers	Robins Green frogs	Forest, prairie, near ponds
Water snake	Consumer	Green frogs Tadpoles	[Great blue heron, raccoons]	In and around ponds

activity 4.3 : schoolyard ecosystem food chains

estimated time 30 minutes

objectives

Students will be able to

1. Identify the primary source of energy plants use to produce their own food.
2. Explain the difference between a producer and consumer.
3. Sequence the flow of energy through a schoolyard food chain beginning with the sun.
4. Classify populations of organisms as producers or consumers by the role they serve in the schoolyard ecosystem.
5. Predict the possible effects of removing a population of organisms from a food chain.

teacher preparation

This activity should be conducted outside in the schoolyard ecosystem. Take a brief, preliminary walk around the area to check for producers and consumers in case students need prompts during the activity.

Students will need their science notebooks to add any new organisms to their *Big Chart: Schoolyard Ecosystem.*

materials

Science notebooks
Pencils
Thermometers
Big Chart: Schoolyard Ecosystem

procedure

1. Have students complete their science notebook headings and take and record outside air temperature.

2. Have students spend a few minutes moving slowly through and observing their schoolyard ecosystem. Have them look at any organism they see and decide whether it is a producer or a consumer.

3. Instruct students to add any new plants or animals observed during this activity to their *Big Chart: Schoolyard Ecosystem* "Organism" column. Instruct students to make an X or check mark to indicate whether each one was a plant or an animal. Instruct students to place an X or a check mark for each of their schoolyard ecosystem organisms to indicate whether each was a producer or consumer.

4. After students have spent at least 10–15 minutes observing and recording schoolyard organisms, have them note using an X or a check mark on the *Big Chart* whether each schoolyard organism is a producer or a consumer.

5. Ask for volunteers or call on students to share an example of a producer and a consumer from their list. Continue until everyone has shared something. Discuss any inaccuracies. Discuss why students may have observed any new organisms today.

6. Have students create at least three schoolyard food chains from their lists in their science notebooks. Have them share these food chains with the class.
   Q. Where did every one of your food chains begin regardless of the producers and consumers you included?
   A. Energy from the sun.
   Q. What role were the plants playing?
   A. Producers using energy from the sun to make their own food.
   Q. What role were all the animals playing?
   A. Consumers getting energy by eating producers or other consumers.
   Q. What might happen if all the producers suddenly disappeared from this ecosystem?
   A. Answers will vary. Consumers would have to find producers somewhere else, if possible.

wrap-up/formative assessment

Have students indicate whether or not pond, forest and prairie organisms on their *Big Charts* are producers or consumers by placing an X or a check mark under the "Producer" or "Consumer" columns in their *Big Charts*.

optional activity 4.a : mdc video segments

Video segments included on *Nature Unleashed* DVD

1. *Owls* (4:49 minutes)—They've gotten a new lease on life...now see how these owls are performing for others.

2. *American Burying Beetles* (5:24 minutes)—Once found on the prairies of Missouri, this endangered beetle has some very unique characteristics.

optional activity 4.b : owl pellet dissection practice

estimated time
30–40 minutes

objectives
Students will be able to
1. Sort and categorize simulated owl pellet components.

teacher preparation
NOTE: In the last few years, vendors have not been able to provide owl pellets. There is speculation that the low number of owl pellets reflects a drop in wild owl populations.

If students are familiar with dissection techniques, skip this practice section and move directly to *Optional Activity 4.C*.

This activity is designed to familiarize students with dissection and sorting techniques in preparation for dissection of actual owl pellets. Students will ultimately investigate owl pellets, which are the result of an owl's specialized stomach muscles. Owls have no teeth and are unable to break and chew food into pieces small enough to pass through their bodies. Depending on what an owl has eaten, fur, feathers and bones are left in its stomach after all the meat has been digested. Special stomach muscles squeeze the fur or feathers tightly around the bones forming a pellet.

These practice pellets are not intended for human consumption. Students will be instructed to place the dissected parts out in their bird feeding area. ***WARNING:*** *Replace peanut butter with soft bread pieces when students with peanut allergies are involved.*

These practice owl pellets must be assembled at least one hour in advance of the activity, but should not require too much time or materials. Only small amounts of the suggested owl pellet recipe items are needed and intended to be items easily available at home or possibly in the school kitchen. A small amount of seed is required, but seed suggested below should be available from seed used for bird feeding activities.

To create practice owl pellets:
1. Mix together the italicized ingredients listed under Materials below. Coconut flakes should comprise the bulk of the pellet. Use the least amount of peanut butter (or soft bread pieces) possible to hold the flakes and other items together.
2. Use a tablespoon or medium-sized melon scoop to separate the mixture into enough pellets to supply one pellet for every two students.
3. Pull out one length of wax paper (approximately 4 inches wide), tear off, fold in half and tear along fold. Repeat until there are enough squares for each pellet.
4. Place one scoop of pellet mixture on a wax paper square and roll into a tight ball.
5. Use the palm of your hand to roll and slightly flatten each ball.
6. Wrap each pellet tightly in the wax paper square.
7. Place pellets in a freezer for at least thirty minutes to allow them to chill enough to hold their shape.
8. Remove pellets from freezer and use immediately.

materials
Materials to make practice owl pellets

Wax paper (approximately 4-inch squares; one square per pellet)
Tablespoon or medium-sized melon scoop
Peanut butter (as needed; approximately ½ cup)
Coconut flakes (approximately 1 cup)
Small bird seed (niger or millet) (approximately ¼ cup)
Sunflower seeds (approximately ¼ cup)
Pretzel sticks broken (approximately) into thirds (¼ cup)

Materials for students

Science notebooks
Pencils
Wooden coffee stirrers and/or toothpicks

Paper plates
Paper towels
Practice owl pellets (one for every two students)
Practice Owl Pellet Worksheet (one per each pair of students)

procedure

Q. What were some of the specialized structures mentioned in Chapter 3 for owls?
A. Ruffled feathers; talons; beaks; huge eyes; ear openings next to the eyes; special stomach muscles that create pellets of undigested animal parts.
Q. What role would an owl play in a food chain?
A. Consumer because it eats other animals and does not use the energy of the sun directly to make its own food.
Q. I wonder why owls are usually considered top consumers of a food chain.
A. Owls eat other animals but are usually not hunted and eaten by other animals because they have specialized structures that make them hard to hear (ruffled flight feathers), hard to see (camouflage), large eyes to see well at night, strong feathers to fly off quickly and high into trees, etc.

1. Explain to students that they are going to solve the mystery of what an owl ate. Owl pellets from the outside do not provide too much information, but on the inside, their secrets and mysteries are revealed.

2. Provide each pair of students with an *Practice Owl Pellet Worksheet*, paper plate, paper towels, wooden coffee stirrers and/or toothpicks and one pellet in its wax paper wrapper.

3. Instruct students to unwrap their pellet carefully and place it on the paper plate. Using the stirrers and toothpicks, have students separate the pellet into smaller pieces.

4. Instruct students to use the key on the worksheet to sort out their pellet parts on the wax paper, then label and sketch each pellet part on *Practice Owl Pellet Worksheet*.

5. Instruct students to use the bottom or back of their worksheet to create a graph to illustrate their data.
   Q. How many animals were in your practice owl pellet? What bones gave you the best clue as to what your owl ate?
   A. The number of skulls found, because skulls are a good indication of the number of animals eaten. An animal would have two hip bones. Dividing the total number of hip bones by two would also be a good clue.

6. Discuss other animal "parts" students discovered in their pellets. These could be vertebra, toe or finger bones, pieces of broken ribs, etc.

7. Instruct students to roll their pellets tightly back up in the wax paper in order to transport them to a place of their choice near their bird feeding area. Suggested places would include directly squashed into the bark of a tree; mashed into a pine cone; on a tray or platform feeder, etc.

wrap-up/formative assessment

See *Wrap-Up/Formative Assessments* in the Teacher Notes section of the introductory material to choose a strategy that meets student needs.

Name _____

Teammate Name _____

Key
Coconut flakes = Fur
Sunflower seed = Skull
Small bird seed = Small miscellaneous bones
Pretzel stick = Hip bone

Sketch the pellet parts in the squares provided:

Pellet content 1: _____ **Number:** _____	**Pellet content 2:** _____ **Number:** _____
Pellet content 3: _____ **Number:** _____	**Pellet content 4:** _____ **Number:** _____

optional activity 4.c : owl pellets—the real deal

estimated time 30–40 minutes

objectives

Students will be able to

1. Sort and organize the contents of an owl pellet.
2. Explain the relationship between what an owl eats and the contents of its owl pellet.
3. Sequence the flow of energy through a food chain beginning with the sun.
4. Predict the possible effects of removing a population of organisms from a food chain.

teacher preparation

Order owl pellets well in advance of this activity. Owl pellets are disinfected and professionally treated.

NOTE: In the last few years, vendors have not been able to provide owl pellets. There is speculation that the low number of owl pellets reflects a drop in wild owl populations.

materials

Science notebooks
Pencils
Owl pellets (one for every two students)
Wooden coffee stirrers and/or toothpicks
Paper plates
Owl Pellet Worksheet (one per student)
Construction paper (black or other dark color) (optional)
Glue (optional with construction paper)

procedure

1. Explain that in this activity students will dissect real owl pellets. These pellets have been specially treated and disinfected.

2. Review the methods students used in *Activity 4.3* to dissect a practice owl pellet. Instruct them to approach the real owl pellet in the same slow, careful manner when opening, breaking apart and sorting the pellet contents.

3. Have teams prepare their science notebook headings and record what they predict they will find inside their pellet.

4. Instruct students to
   a. Separate bones from fur.
   b. Use the key to sort bones and transfer to correct box on *Owl Pellet Worksheet.*
   c. Record the number of bones in each group on *Owl Pellet Worksheet.*
   Q. How many animals were in your owl's pellet? What bones gave you the best clue as to what your owl ate?
   A. The number of skulls found, because skulls are a good indication of the number of animals eaten.

5. Discuss numbers of other bones students discovered in their pellets.
   Q. Besides counting skulls, what would be another way to decide on the number of animals eaten?
   A. Counting lower jaw bones (2/animal); counting hip bones (2/animal); counting upper leg, shoulder or lower leg bones (2/animal). Upper and lower leg bones and shoulder bones may be fragmented and more difficult to identify.

6. Owls usually cough up two pellets every day. Instruct each team to decide the number of animals eaten by their owl and to use that number to provide the following information about their owl:
   a. Number of animals eaten in one day.
   b. Number of animals (potentially) eaten in a week.
   c. Number of animals (potentially) eaten in a month.
   d. Number of animals (potentially) eaten in a year.

7. Go around the room and have teams state the number of animals found in their pellets.
   Q. Based on the number of the animals in all of your pellets, answer the following:
   a. Average number of animals eaten in one day.
   b. Number of animals (potentially) eaten in a week.
   c. Number of animals (potentially) eaten in a month.
   d. Number of animals (potentially) eaten in a year.
   Q. How did pellet contents differ among class pellets?
   A. More of certain bones than others. Some had larger bones. Some had small bones and broken or no signs of skulls, etc.
   Q. Why would there be differences?
   A. Different owls produced these pellets. Owls living in different areas might have more birds or more mice/voles.
   Q. Based on the total number of animals eaten in a year, what effect do you think owls have on a Missouri forest ecosystem?
   A. Owls control populations of mice and other rodents. Owls help balance populations of mice, voles and other animals. Without owls, there would be greater numbers of mice and other rodents.
   Q. If a population of owls was greatly reduced or entirely removed from a forest ecosystem, what would be some possible effects on the ecosystem?
   A. Answers may vary. Rodent populations would increase. More producers (plants, seeds, etc.) would be eaten by the rodents reducing the amount of producers available for other consumers. Other animals that eat rodents would have lots of food. Too many rodents might cause diseases in rodent populations that could spread to other animals, etc.

extension activity

1. Have teams use their bone charts and their pellet bones to reconstruct a skeleton of one animal and glue it onto the construction paper. Were all bones available? If not, why?

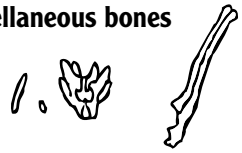
2. Have teams share their reconstructed skeletons with the class.

wrap-up/formative assessment

Have students create possible food chains that could have led up to their owl based on pellet contents. Have them label food chain organisms as producers or consumers. Check for correct inclusion of the sun.

Name _____

Teammate Name _____

Skull 	
Jaw 	
Shoulder blade 	
Hip 	
Upper leg 	
Lower leg 	
Ribs 	
Back bones 	
Extra/miscellaneous bones 	

optional activity 4.d : beaks, seeds and places to eat

estimated time
30–40 minutes

objectives
Students will be able to
1. Explain how birds are able to eat both plants and animals without the use of specialized tooth structures.

teacher preparation
This is an outdoor activity and is relevant to the ongoing, daily bird feeder observations and data collection by students.

Have students check that bird feeders are full at least a half-hour prior to the activity to allow birds time to return to the feeders after students have filled them.

Ideally, students would observe and collect data on bird beaks and feeding behaviors for 10–15 minutes two to four times each day for several days at several different locations. If one class period is all that is available, instruct students to observe and record data for several short lengths of time (depending on the length of the class period) with brief rest periods in between. A rest period would be very short (three to five minutes) and could involve students standing up quietly to stretch their legs and moving slowly to another (predetermined) observation position for the next round of observations.

materials
Science notebooks
Pencils
Thermometers
Binoculars (optional)
Bird field guides
Watch/Stop watch (optional)
Thermometer

procedure
1. Explain to students that they will be collecting very specific data on the way birds eat at feeders. If they work in groups, each group should decide how they will record this information (Ex: chart with name of bird/number of times that type of bird ate a specific seed/beak description of that bird/eating method/preferred seed; chart with type of seeds/names of birds eating each seed [or peanut butter]/shapes of seeds/shapes of bird beaks/number of times each type of bird visited a particular seed; etc.)

2. Instruct students to move quietly and slowly to their observation spots (predetermined by you or decided upon by the students) and to have their science notebook*s* and pencils ready to record data.

3. When data from all observation sessions has been recorded, instruct students to work in their groups to compile and organize their data and prepare a class presentation. Presentations should address the following:
   a. Number of specific types of birds that ate only one type of seed.
   b. Beak shape(s) of observed bird(s); how they differed; how they were similar.
   c. Comparison sketches of beaks and seeds (use field guides, if necessary).
   d. Conclusion as to why certain types of birds prefer certain foods.

   Q. Why would cardinals, chickadees and tufted titmice all eat black oil sunflower seeds?
   A. Black oil sunflower seeds are a good source of energy.These birds have similar shaped beaks that allow them to crack the sunflower seed shells.
   Q. How often did a certain type of bird remain at a feeder, or how often did a certain bird (or even the same bird) take a seed to another spot, eat it and return for another one?
   A. Answers will vary, but chickadees and titmice do this often.
   Q. Were there birds that ate insects, seeds and insects, only peanut butter, etc.?
   A. Answers will vary, but if nuthatches and woodpeckers were observed, they could be interested in the peanut butter/suet. Answers will also vary depending on the time of year and the availability of natural food and insects.

Q. What might this tell us about these birds?

A. They are all responding to internal hunger cues while responding to external weather cues (taking shelter under the top of a feeder while feeding from it), to potential danger cues (grabbing a seed and flying to a higher branch of a tree to eat it), etc.

Q. Why were there birds that only ate seed that had fallen to the ground?

A. Answers will vary depending on the time of year. Some birds found in Missouri only in the winter include white-throated sparrows, fox sparrows and dark-eyed juncos. These birds tend to feed on the ground. Mourning doves are found in Missouri all year and are often observed feeding on the ground. All of these birds utilize areas under brush piles and bushes as places to find seed. The brush piles offer shelter and protection from predators and weather. Students should look closely to record the type of seed these ground-feeding birds prefer.

Q. Are there other body structures besides beaks that determine where a bird might prefer to eat? Are bird feet specialized structures that influence where they feed?

A. Woodpeckers do have very special toe arrangements that allow them to grip the sides of objects. Woodpeckers also have specialized tail feathers that provide support for woodpeckers when they are moving about on a vertical object such as a tree trunk.

4. Based on all presentations, discuss with class what beak shapes were most common and why.

5. Have students sketch in their science notebook*s* the beaks of birds observed. Have them write a short description of a meal they might be able to eat if they had one of those beaks rather than a human mouth with teeth (Ex: walnuts without using a nutcracker to get out the seed; giant insects; an uncut watermelon; etc.).

so, what do you know?—lesson 4

1. Where do plants get the energy they need to produce their food?

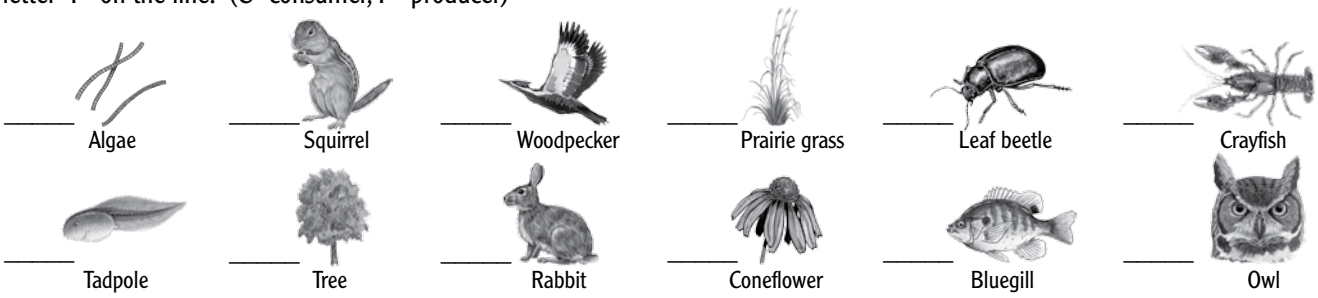
   a. Animal b. Plant c. Sun d. Water

2. Plants produce their own food. So they are called:

   a. Consumers b. Decomposers c. Populations d. Producers

3. What is the difference between producers and consumers?

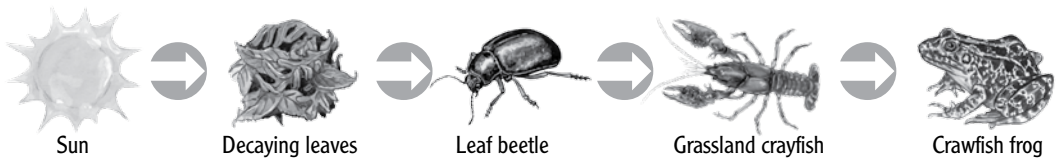
4. Identify which organisms are consumers by placing the letter "C" in the line next to the picture. For producers, place the letter "P" on the line. (C=consumer, P=producer)



5. Make a food chain using the pictures below. Put a number 1 by the first thing, number 2 by the second thing and number 3 by the third thing in this food chain.

6. Use words or pictures and words to make a pond ecosystem food chain with four links.

7. A food chain is pictured below. What could happen if all of the leaf beetles died from disease?



so, what do you know?—lesson 4

answer key

1. Where do plants get the energy they need to produce their food? (1 point)

   answer— c. Sun

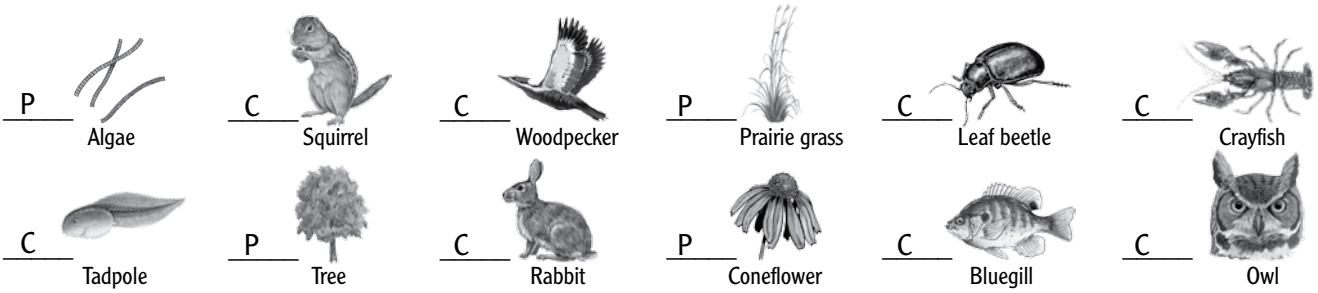
2. Plants produce their own food. So they are called: (1 point)

   answer— d. Producers

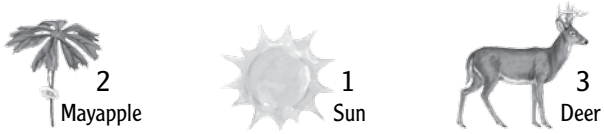
3. What is the difference between producers and consumers? (2 points for answers that convey the same meaning as the answer provided below)

   Producers use the energy from the sun to produce their own food.—*AND*—Consumers eat plants or other animals to get the food and energy they need. They can't produce their own energy.

4. Identify which organisms are consumers by placing the letter "C" in the line next to the picture. For producers, place the letter "P" on the line. (C=consumer, P=producer) (1 point for each correct answer, max. 12 points)



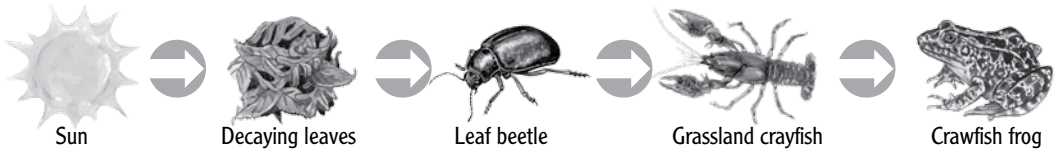
5. Make a food chain using the pictures below. Put a number 1 by the first thing, number 2 by the second thing and number 3 by the third thing in this food chain. (1 point)



6. Use words or pictures and words to make a pond ecosystem food chain with four links. (4 points)

   answer —Any food chain found in a pond ecosystem is acceptable as long as it has: sun, plant, herbivore or omnivore and omnivore or carnivore.

7. A food chain is pictured below. What could happen if all of the leaf beetles died from disease? (4 points for any one of the following answers)



possible answers

The crayfish would have less food to eat; Some crayfish might die because they didn't have enough food to eat; There may not be any animals to eat the decaying plants; The frogs might not have enough crayfish to eat; or other plausible answer.